REMARKS/ARGUMENTS

After the foregoing Amendment, Claims 1-3, 7-11, 16 and 21 are currently pending in this application. Claim 11 has been amended to add the limitation "only", which had previously been added to the other independent claims, as noted by the Examiner.

Claim Rejections - 35 USC § 102

The Office Action rejects Claim 11 under 35 USC § 102(b) as being anticipated by Buzzi ("Blind Adaptive Multiuser Detection for Asynchronous Dual-Rate DS/CDMA Systems" IEEE Journal on Selected Areas in Communications Vol. 19 No. 2 pp. 233-244, February 2001) in view of Saito (US 6,615,030 B1).

Note that because two references were cited in this rejection, Applicant believes this rejection may be under 35 USC 103.

The present application claims extracting information from a received composite signal containing both high-power/high-data rate data signals and low-power/low-data rate voice signals. Initially, the data signals are extracted using a first detector of a first type (the first detector is a blind minimum mean square error detector). Then, the contribution of the (just-extracted) data signals is canceled from the composite signal, and the voice signals are extracted using a second detector of a second type (the second detector is a matched filter or a RAKE-receiver). It is appropriate to begin by extracting only the data signals from the

composite signal because the data signals have a greater interfering effect on the voice signals than the voice signals have on the data signals. The combined complexity (and therefore the power consumption) of the circuits needed to extract only data in a first stage and only voice in a second stage is less than the complexity of the circuits needed to extract both types of signals in a single stage. No similar concept is disclosed or suggested by the cited prior art.

In contrast, Buzzi is an evaluation of three access schemes in an environment in which users transmit their symbols at one of two available data rates, a high data rate or a low data rate. The performance of the access schemes is compared "for the case that a linear one-shot multiuser receiver is employed." A one-shot multiuser receiver is concerned with determining information from only one particular user signal at a time. Although two types of detectors (decorrelating and MMSE detectors) are considered in Buzzi, they are not used in conjunction with one another, as they are the present application, and no suggestion is made in Buzzi that they be used in conjunction with each other. Instead, in Buzzi the performance of each access scheme independently detecting first one, then the other, of two generalized users is considered. For the first user, "the low-rate user '0' is the user of interest" (Buzzi, page 234, last paragraph). For the second user, "the high-rate user '0' is the user of interest" (Buzzi, page 235, left column, paragraph beginning "Let us now specify..."). Each generalized user signal is detected completely independently of the other. Nowhere does Buzzi disclose or suggest that one or more signals of a first type be detected and removed from a composite signal to

enhance the detection of the remaining signals of a different type, as does the present application.

In fact, Buzzi (page 236, left column, bottom paragraph) notes that "it is seen that, for the high-rate users, the VCR access technique performs better than the VSL while, on the contrary, for the low-rate users, the VCR is worse than the VSL." From this observation, Buzzi might have suggested (but instead <u>failed</u> to suggest) that the access technique that performed better for the high-rate users could be used to detect the high-rate signals, then remove those signals from the composite signal, then the access technique that performed better for the low-rate users could be used to detect the low-rate signals. Instead, Buzzi notes (page 236, top of right column) that a completely different access scheme "is seen to outperform the other two access schemes for both the low-rate and high-rate signals." Thus, Buzzi does not combine different types of detection devices to improve receiver performance, but simply assesses the performance of different individual access schemes.

Regarding claim 11, the Office Action depends on Buzzi for an interference canceling device for receiving the detected data of the high power level group of data signals and canceling a contribution of the high power level group detected data from the plurality of communication signals, as an interference canceled signal (page 234 equation 3, figure 5 page 240). However, this limitation does not exist at the cited location, nor elsewhere in Buzzi. Instead, equation 3 gives the spreading sequence for the *k*th low-rate user in the VCRFS access method. Notably, in equation 3, "The parameter $f^{(l)}$ is the frequency offset between the carrier

frequencies of the low-rate and high-rate CDMA signals. It is understood that, as $f^{(l)}$ increases, the mutual interference between the high-rate and low-rate users vanishes". In an environment in which the signals of high-rate and low-rate users do not interfere with each other, there is no advantage to removing one type of signal before detecting the other. Thus, the equation cited in the Office Action as embodying a feature of the present application, contrarily in fact describes an access method whose performance improves in an environment which renders that very feature unnecessary.

Furthermore, neither does Buzzi in figure 5 page 240 disclose an interference canceling device for receiving the detected data of the high power level group of data signals and canceling a contribution of the high power level group detected data from the plurality of communication signals, as an interference canceled signal, as does the present application. On the contrary, Buzzi in figure 5 discloses a cyclic RLS algorithm, which enables a time-varying blind adaptive implementation of a linear MMSE detector for use in detecting <u>only</u> the high data rate users. As noted in Buzzi (beginning on the bottom of page 238), "The time-varying receiver may be realized through a time-invariant processing preceded by a set of complex oscillators, ... the time-varying part of the algorithm is thus confined to the bank of complex oscillators. The time-invariant processing amounts obviously to a multiplexer (MUX) and to a block implementing the RLS procedure (18) followed by the final decision circuits implementing the decision rule...." Thus, although figure 5 looks somewhat like it might be interpreted to be a receiver in which a received

composite signal *r(n)* is processed in some way, and the results of that processing are removed from the composite signal to obtain an interference canceled signal, a careful reading of Buzzi section IV and the Appendix makes it clear that is not what is being shown in figure 5. Instead, Buzzi figure 5 shows only a <u>single</u> time-varying blind adaptive MMSE detector, for use in detecting <u>only</u> high data rate users. In figure 5, the received signal *r(n)* is expanded using a Fourier series expansion, the terms of which are then combined in a MUX, the output of which is input into a cyclic RLS block, the output of which, $m_0(n,n)$, is input into a decision circuit (<u>not</u> into an interference canceller). The decision circuit also has as an input the received signal *r(n)*, and an output $b_0(n)$. The output $b_0(n)$ is simply a detected bit of a particular high data-rate user, as indicated by equation 15, and is not an interference cancelled signal, as recited in Claim 11 of the present application.

Thus, Claim 11 with an interference canceling device is easily distinguishable from Buzzi, which does not disclose an interference canceling device. Thus, Claim 11 is believed to be distinguishable over the cited prior art. Withdrawal of the rejection of Claim 11 is respectfully requested.

<u>Claim Rejections - 35 USC § 103</u>

Claims 1-3, 7-10, 11, 16 and 21 are rejected under 35 USC 103(a) as being unpatentable over Keskitalo (US 6,128,486) in view of Moshavi (US 2004/0090906 A1); in view of Karlsson (US Patent Application Publication US 2002/0057730), and further in view of Saito (US 6,615,030 B1).

As to Claim 1, the Office Action states that Keskitalo discloses a system for multiuser detection of a received signal, the received signal including voice signals and data signals. However, Keskitalo does not explicitly disclose either voice signals or data signals, nor a combination of the two. Instead, Keskitalo is concerned only with generic signals in a CDMA communication system. In marked contrast to the present application, Keskitalo does not teach or disclose receiving a composite signal including both voice signals and data signals, wherein the voice signals are lower power than the data signals. Rather, Keskitalo only teaches receiving a plurality of signals from a plurality of different mobile stations. In Keskitalo, each signal is detected by the same devices. Keskitalo does not disclose receiving signals of different types, and presumably the received signals in Keskitalo are all of the same type. Interference is reduced on a particular desired received signal in Keskitalo by canceling the contribution of the strongest of other signals (presumably of the same type) received at the same time. Keskitalo reduces computational complexity in the detector by using phasing of multiple antenna elements to improve the receiver sensitivity in the direction of the sources of the strongest interfering signals, to more effectively cancel the contribution of only those signals on the desired signal. Keskitalo does not disclose or suggest using a first detector to extract signals of a first type, nor canceling the contribution of those signals on the composite signal, nor using a second detector to detect signals of a second type in the interference cancelled composite, as does the present application. Keskitalo is not concerned with, nor directed to, nor does Keskitalo even mention, a

communication environment in which signals of different types are used, or the problems associated therewith. Keskitalo does not even suggest canceling the contribution of an entire group of signals of any kind from a composite signal. Rather, Keskitalo discloses only canceling the contribution of a few specific selected signals, of the same generic kind as a desired signal, from a composite signal. As to these limitations, the present application is easily distinguishable from Keskitalo. Thus, although Keskitalo does disclose interference canceling, Keskitalo does not disclose or suggest anything it could reasonably be combined with to arrive at the present invention.

Moshavi, however, is directed to a communication environment in which signals of different data rates are used. However, Moshavi solves this problem in a way which is dramatically different than the present invention. In Moshavi, a three-stage detector is used to detect high-rate and low-rate users in a composite signal, but no signal cancellation is used. The first stage is a high rate detector applied at the high symbol rate "to process the low-rate users as well as the high-rate users.... multiple low-rate users collapse into a single 'effective' high-rate user.... The high rate detector 32 generates soft outputs for the actual high-rate users and the effective high-rate users." (Moshavi paragraph [0036].) The second stage 34 applies a high-rate linear MMSE transformation to the output of the first stage (containing soft outputs for both the high- and low-rate users) which decouples the high-rate user and low-rate user outputs. The third stage is applied only to the low-rate user outputs. Thus, the problem of detecting both high data-

rate user signals and low data-rate user signals from a composite signal is solved without the use of interference cancellation as required by the present invention. Since Moshavi is directed to the problem of detecting multi-rate signals, as is the present invention, but solves that problem in a completely different way that doesn't use signal cancellation, there can be no motivation to combine Moshavi with the signal cancellation concept of Keskitalo, since the problem of multi-rate detection has already been solved in Moshavi without it.

The Office Action depends on the combination of Keskitalo and Moshavi to anticipate these limitations in independent claims 1, 7, 11, 16 and 21. Thus, these claims are believed to be patentably distinct from Keskitalo in view of Moshavi. Withdrawal of the 35 USC 103(a) rejection of claims 1, 7, 11, 16 and 21 is respectfully requested.

Claims 2 and 3 depend from claim 1, and claims 8-11 depend from claim 7, and thus are also believed to be patentable. Withdrawal of the 35 USC 103(a) rejection of claims 2, 3 and 8-11 is also respectfully requested.

Conclusion

If the Examiner believes that any additional minor formal matters need to be addressed in order to place this application in condition for allowance, or that a telephone interview will help to materially advance the prosecution of this application, the Examiner is invited to contact the undersigned by telephone at the Examiner's convenience.

In view of the foregoing remarks, Applicants respectfully submit that the present application, including claims 1-3, 7-11, 16 and 21, is in condition for allowance and a notice to that effect is respectfully requested.

Respectfully submitted,

Reznik et al.

By MBerman

Michael L. Berman
Registration No. 51,464

Volpe and Koenig, P.C.
United Plaza, Suite 1600
30 South 17th Street
Philadelphia, PA 19103
Telephone: (215) 568-6400
Facsimile: (215) 568-6499

MLB/ml